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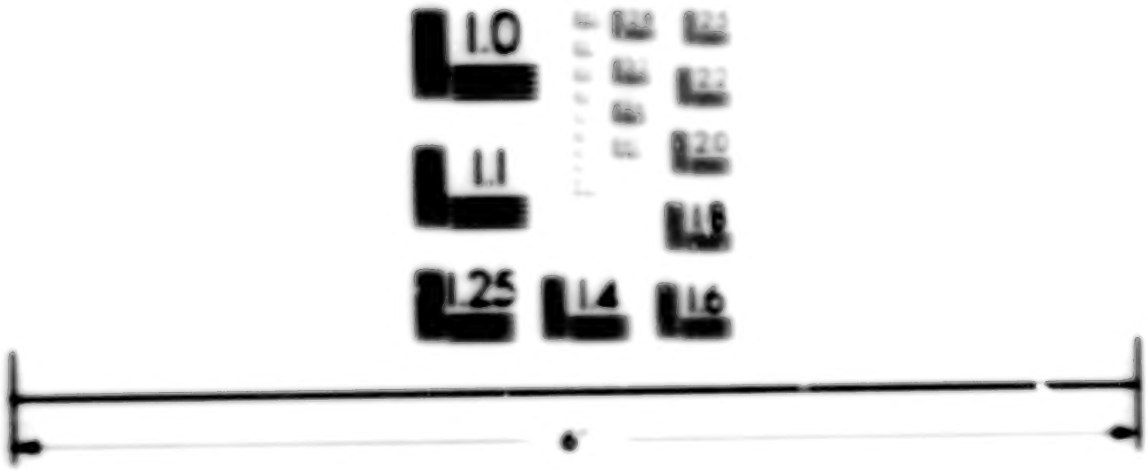

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FBIS-USSR-96-011 21 March 1996

CONTENTS

SCIENCE AND TECHNOLOGY POLICY

SPACE SCIENCE AND ENGINEERING

PHYSICS

CHEMISTRY

EARTH SCIENCES

Russian Ministry of Science Official Comments on Reform Progress

90420/9/NA *Moscow PRIRODA in Russian* Nov 95 No 11 pp 5-12

Interview with Doctor of Physicomathematical Sciences, Gennadiy Vikhorevich Kozlov, RF deputy minister of science and technology policy, professor by I. N. Arzumanyan and T. Yu. Lisovskiy; place and date of interview not given. "Reforms in the Backdrop of Impoverishment: What Is Happening With Russian Science?"

[FBIS Translation] Text: Gennadiy Vikhorevich Kozlov, *RF deputy minister of science and technology policy, doctor of physicomathematical sciences, professor. Since 1991 division director of the Russian Academy of Sciences Institute of General Physics. Specialist in solid state physics and submillimeter spectroscopy. Author of over 200 scientific works. Teacher in the physics faculty of Moscow State University.*

Russian science's difficult situation is a perpetual topic of discussion. Articles on this topic contain a great deal of emotion as a rule, but few facts and figures. For them, we went to the RF Ministry of Science and Technology Policy.

Deputy minister, Doctor of Physicomathematical Sciences Gennadiy Vikhorevich Kozlov graciously consented to explain to associates of our journal, I. N. Arzumyanyan and T. Yu. Lisovskiy, what is happening in science, and how its reforms is progressing.

[PRIRODA] Many shortcomings were recognized to exist in our scientific centers even before. Bought matters never went further than discussions regarding the need for reorganizing it. Now that the situation in science has become truly catastrophic, many scientists have developed a nostalgia for "pre-perestroika" times. People have come to realize that Russian science was no worse than foreign science, that in many ways it was even better, and its shortcomings are now seen more as a continuation of its merits. Please tell us, Gennadiy Vikhorevich, aren't you afraid that in embarking upon reform of science, you will throw out the baby with the bath water? Do you have a unified concept, and if so, what is it?

[Kozlov] In the USSR, science was one of the most privileged institutions. Huge amounts of money were spent on scientific research. From 2.5 to 4 million people were employed at different times in science. The level of scientific developments did not always meet world standards, but at the same time Soviet science was on the leading edge in many areas. Despite all of the comments and shortcomings, the scientific potential inherited by Russia is one of its most important assets.

To make what science and culture became the first victims of the economic crisis that has struck our country? Budget financing decreased by several times, and when you consider the astronomical increases in payments for municipal services and the higher cost of communications, the volume of resources actually reaching scientists remained has decreased by over 90 times. In fact these conditions Russian science has started falling apart quickly, and the prestige of scientific work in the eyes of the society has fallen together with its pay. [illegible] The number of scientists, associated strata by a factor of seven times, and the same number of people are in original science of all working in development. Can I unfortunately [illegible] the whole people that have left Russian science.

But I think that the destruction process can not be stopped. As we said, it is [illegible] that the financing of science will be [illegible] in the current quarter in the new low scale. It was at begin lighting together for budget [illegible] we could perhaps achieve financing [illegible] approximately [illegible] percent of the expense side of the budget. From percent [illegible] estimations. What the means for practical performance that [illegible] will be allocated [illegible] in the new low scale. That before. Must we have also to persuade the scientific community [illegible] the fundamental reorganization was necessary, we might have worked out a better concept and attract to the reform also particularly. But now [illegible] to postpone, and we will have a [illegible] working in an additional manner.

How do you assess the state of Russian fundamental science? Let's consider the fundamental and applied sciences separately.

As a rule, the fundamental sciences are [illegible] higher a self-developing system, and it is difficult to determine their priorities at this time. While [illegible] about fundamental research, [illegible] the state and scientists are [illegible] very well informed about all work going on in their fields. The main reasons the scientific community has proved itself in the advantageous lack in teaching [illegible] in science. We saw this for example in the discovery of high-temperature superconductivity. As soon as the report appeared that the temperature of transition [illegible] a superconducting state [illegible] the order of 90 K, was attained, this news changed all scientists, for contrary to several days. Without even waiting for a decision from institute directors, and at the risk [illegible] the leadership, scientists decided that they had [illegible]

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change their plans and go into the new fields. As things turned out, the government wasn't ready and under the influence of the scientists, continued to give to support to this direction. After that, the process went on extremely rapidly. Essentially all specialists in solid-state physics were swept into the mainstream regardless of what they had been studying before. Things accelerated to a colossal tempo, and the situation changed literally every day. Information was exchanged by electronic mail and by telephone. That the results were brilliant is another matter. The USSR, Germany and Japan, where huge amounts of money were channeled into this direction, developed. They weren't much better. This is an example of how intense competition in the fundamental sciences—and how competition forces people to work.

Russian physics now spins collectives—so-called schools—that exhibit over a period of many years. They are of great value, and they need to be supported. World science is organized according to another principle. In the U.S., for example, the pace of life is high and people change jobs and homes frequently. In our country in the meantime, scientists live a moderate way of life, many of them working in the same town all of their lives. They enter it as students and stay it on retirement. Although this has many negative consequences, there was an important positive factor. Gradually, naturally, terms by active scientists, collectives came together in which people complemented one another very well. One carefully followed the literature, another generated ideas, a third possessed a practical mind, a fourth built new devices day and night, and so on. The schools took shape over a long period of time, and now they are an object of envy among foreigners who are deprived of the possibility for studying one subject all of their lives.

For most Western scientists, science is an charitable occupation, as well as a source of reasonable earnings. But in Russia, what was more important in the work of scientists was not the earnings but the interest. Naturally Russian science was continuously engaged in many directions, even though in technical regards it was always rather poorly equipped, especially with computers and computers. And I feel that fundamental science should now return until not so much on directions as on schools. If we support the strong schools, they would themselves determine their own plans and carry out the research that will turn out to be more important to our society.

The amount of resources allocated to fundamental research is not great, and therefore if we are to carry on the work at a good level, we will have to reduce the number of directions of this research. For practical purposes many scientific schools have found themselves unable to work. What matters now is support to the strong schools, the strong leaders.

(PROBLEMS) Through what departments will the scientific schools be supported?

(KOLESOV) The systems in which this resources are allocated through the Russian Fundamental Research Fund (RFFI), but a special consult selects the schools to be supported. Financing is to begin at the end of the year. For the moment we are developing the criteria, and soon we will begin allocating the money. As for how the procedure will be organized in 1996, that still has to be discussed and decided.

One of the more important accomplishments in the reform is creation of numerous means of financing—so-called funds, which allow scientists actively working in the priority directions to receive money not just from their customers alone. The activity of the funds is improving all the time, and the share of resources channeled through the RFFI, the Humanitarian Fund and others is increasing. In the past our ministry was responsible mainly for the natural sciences. But now we are started providing assistance to the humanitarian directions as well. The issue of transferring percent of all money allocated to science to the Humanitarian Fund has already almost been resolved. If we are able to do this, the situation will improve for specialists in the humanities, lawyers, psychologists, etc.

One of the ways in which Russian science is supported is through international scientific competition. In this time of transition we are prepared to conduct research through the efforts of our collectives on the basis of orders from the West or the East. This is the sale not of science as many people say, but of the results of scientific research.

In the 1 years that I have worked in the ministry I visited a huge number of institutes throughout the entire country. There scope is astounding. During the years of socialism we built many unique scientific facilities that are one of a kind in the world. But unfortunately we are presently unable to exploit them adequately. The fate of unfinished facilities is especially tragic. A classical example is the UNK-400 accelerator in Protvino. The tunnel is almost finished, but if we continue to move on at the rate at which the allocated money allows, it would be a miracle to completely finish the facility in 30 years. But by then, would such an accelerator even be needed?

We presented information on unique Russian experimental devices at a conference in Paris, and we offered

to share their use. My hope is that our offer will garner the response.

Germany has already given a high assessment to the prospects and originality of the enhanced devices.

[PRIRODA] Is the idea to sell these facilities, or to rent them to the international scientific community?

[Kostov] There can be various organizational forms. Let me cite an example. There is a huge 600-m diameter radio-telescope near Moscow. Its work load is low, and it could be utilized 10-20 times more effectively. We would be happy to open it to foreign partners to conduct research—jointly with us or not, in return for money to maintain the telescopes, which would be extremely advantageous to us.

The idea came up for creating joint laboratories located mostly or in part in Russia. We could train personnel for the directions of research in which we hold the leading positions.

[PRIRODA] Would this be something along the lines of the International Mathematics Institute (item 1) Euler established not long ago in St. Petersburg?

[Kostov] These will most likely be smaller entities. We can't count on foreign partners investing money into an entire institute. Cooperation could be organized very quickly, and conducted productively in collectives of 50 or 60 individuals.

[PRIRODA] And how is the reform proceeding in the Russian Academy of Sciences?

[Kostov] The need for the academy's reform came into being long ago, 20 years in the past, but they didn't get around to it then, and now reform has superimposed itself over the absence of money, making it doubly hard to carry it out. While this could have been done skillfully and beautifully in the past, now we have to carry it out in extremely serious economic, or financial, All postponements of any decisions make things very complicated.

The necessity of the transformations is now being recognized in the academy. Yu. S. Osipov said in the last meeting of the RAN [Russian Academy of Sciences] Presidium that we need to find ways to adapt the academy to new conditions. An attempt was made to discuss reorganization of the RAN's divisions. Unfortunately only the Information Science Division is prepared for this at the moment; the rest stated that there was no need for this. But the first step has been taken.

The Academy of Sciences and its institutes must undergo self-reform. It would be very wrong to impose a single scheme upon the academy, and all the more so the institutes. Each is unique, and it would be best if a specific model were developed for each one. We already have some positive examples. The Institute of Nuclear Physics (item 1) L. I. Rudkin and the Institute of Catalysis (item 1) G. K. Boreskov of the RAN Siberian Department managed to organize effective international cooperation, as a result of which they were able to achieve a good level of financing of scientific research and wages for the associates. Or consider the Institute of Spectroscopy in the city of Troitsk, where the administrative staff was cut and the divisions were granted financial independence. In this case the institute was able to retain its scientific rating, and the number of its publications did not decrease even after a significant cut in the number of associates.

I think that the ball is rolling, as they say, and we need to turn the community's attention to the reform, since after all, as soon as positive examples appear, events begin to develop very rapidly.

Now let's go on to the applied sciences. This is a strategically important sphere for every industrial country. It is precisely here that the results of fundamental research are practically implemented. The number of scientific research projects in our country is simply monumental. There is an institute in the Ministry that keeps account of finished research projects. It has a huge library, and over a million reports are registered there. Not everyone understands that what society really needs is not science as such, or even scientific research, but utilization of its results. In our country, fundamental sciences are a huge river, applied sciences are a stream at high water, and applications are a tiny creek.

The time has come for us to seriously analyze our possibilities in regard to completed applied scientific research projects, and to try to utilize them ourselves or sell them at a profit to foreign partners. We are creating special agencies for this purpose, which should help people to find partners abroad and to properly word the scientific contracts. After all, foreign entrepreneurs are attempting to buy the results of huge research projects for peanuts, and they are often able to do so because people brought to despair by the circumstances of their lives are forced to make concessions in order to solve immediate problems.

It is very important for us to study how to work in the Western market. It is no secret after all that our developments are often packaged unattractively, and they require significant sprucing up. The simplest form of cooperation would basically be one in which the principal units would be manufactured here, and then assembled abroad, where marketing, patent protection, sales and service would be carried out. It would be hopeless to go to market with our rules—we need to get

used to international standards. Recently we established one such agency together with Berlin's senate (its office is situated in the RAN Crystallography Institute) and we equipped it with the help of the German side.

Germany is very interested in active cooperation with Russia in production technology. Europe is worried that America might buy up all Russian developments. Competition between America and Europe in technology is doubtlessly very serious. The Germans understand all of this quite well, and are opting for cooperation that goes beyond immediate advantage. Berlin's senate is striving to work with us seriously and long. Russia will soon undergo a technological revolution, and everyone is getting ready for this. Russia is a huge market for new technology. Our equipment is highly outdated at the plants, and we will be compelled to acquire new equipment. Naturally by having experience in joint work with us, Germany could be the first to enter our market.

[PRIRODA]: Many small firms developing science-intensive technology—industrial parks (technoparks)—have opened in Moscow State University. Do they have any relationship to state departments?

[Kuzelov]: As a rule, the industrial parks either rent or bring out for VUZes (higher educational institutions), and there are many industrial parks working reasonably well at Moscow State University, in the St. Petersburg Electrical Engineering University, and at Moscow Technical University. This movement is now starting to expand, and to penetrate into large military institutes such as Astrofizika. I was surprised to find that this large firm, which used to develop high-power military lasers, has begun manufacturing high-quality, rather inexpensive valves in its industrial park. They took the easy road: they developed a good self-contained system for finding and evaluating projects—what kind is unimportant, so long as they are effective, feasible, and mutually advantageous. People will always need medical attention, meaning that you can work with medical projects. One other direction that guarantees success is methods of protection from, for example, electrical injuries.

This, generally speaking, is the most important thing happening today: developments oriented on market needs sell well even in our difficult times, and the turnover of resources is rather quick.

We are currently considering different versions of the state's share of participation in certain developments carried out by industrial parks. What is attractive is that the firms won't support a bad project—they are risking their own money.

[PRIRODA]: Are you counting on a return of invested money?

[Kuzelov]: There are different ways to handle this. We are prepared to support some projects without remuneration. I feel that the larger part of the applied projects must be financed on a reimbursable basis. For this purpose we established the special Fund for Assistance to Development of Small Enterprises in Science and Technology a year and a half ago under the ministry. It is headed by my predecessor, I. M. Bortnik. This fund holds 0.5 percent of all budget resources for civilian science. We specially decided not to support large state structures, for which this money isn't enough anyway. In reforming the scientific sphere, it is important to organize small enterprises in which people who come up with the ideas could realize them themselves. The Fund has an expert panel, and resources are granted on a reimbursable basis on its recommendations. The interest does not exceed half of the bank credit interest rate. Interest-free loans are available as well.

The Fund is working extremely effectively, and I think that this scheme should be extended to industrial parks that are working well. We could of course organize a new state structure to evaluate and implement the projects, but it seems to me that this path would be ineffective. We could achieve greater success with investments through share partnership than in a private business.

By investing our share, we multiply the resources, and, more importantly, we develop small business, the role of which is exceptionally great in modern society.

[PRIRODA]: Where does the money that is returned go?

[Kuzelov]: If not returned to the ministry's central, it will accumulate in the Fund, where it will be remained for the same authorized purposes. It might happen that with time, we will no longer have to give money to the Fund—that is, it will become self-supporting, although I don't think this will happen very soon. There isn't much money, and we have to keep investing it in order to get scientific business to begin developing. After all, the Fund supports not only the projects but also the infrastructure, conferences, and publication of books and analytical surveys.

But the larger problems lie with scientific research institutes that work solely on large defense projects. These unique enterprises have found themselves in an extremely grave situation upon losing their orders. Understanding the complexity of the situation, I urged ago the ministry took a very risky step and began establishing state scientific centers (GNT).

[PRIRODA]: Are you referring to centers like Arzamas?

[Kuzelov]: No. The centers you're referring to are under the Ministry of Atomic Energy, and they are called territorial centers. I'm not talking about them. I'm referring to

state scientific centers established by a special presidential edict. According to this edict they receive additional financing and privileges. There are 60 such centers today. I would say that there are too many of them. The desire to join their number is so great that competition is enormous, several hundred centers are on the waiting list. I feel that this idea has been taken too far. The state is able to support around 20 centers.

In the first stage, when that's how many centers we had, we were actually able to hold them out. But unfortunately we made poor use of the chance to carry out reorganization. Obviously we should have imposed rigid conditions right from the start. But as things turned out, the money that was allocated to them went much more to preservation than to reorganization. By the way, a center is awarded the status not for all time, but for 2 years, after which we are supposed to summarize the results, and in principle, we could lift these conditions. We have done so for example for the Institute of High Energy Physics (IFVE, Protvino), the Physical Power Engineering Institute (FEI, Obninsk), the Institute of Theoretical and Experimental Physics (ITEF, Moscow), the Kurchatovskiy Institute, the Central Aerohydrodynamics Institute, the Aviation Materials Institute, the Ship Building Institute (named A. N. Krylov in St. Petersburg), and several chemical scientific research institutes. There will be an exhibition of the accomplishments of the centers at the end of the year.

[PRAVDA] You said that these centers have privileges. What kind?

[Kozlov] Yes, they do, particularly when it comes to paying for electricity, but unfortunately these privileges are not being honored in Moscow: there are so many centers here that the city administration can't compensate for the losses suffered by the power engineers. But in St. Petersburg, these centers do enjoy these privileges. There are certain restrictions, however: for example they do not have the right to become privatized, or to rent space without special permission. There are a large number of other restrictions. After the exhibition we will certainly analyze the work of each center, and after that, the question as to how to transform the system will come up, because this system has to be transformed, since it uses up a very significant share of the ministry budget.

[PRAVDA] Doesn't this create the soil for corruption?

[Kozlov] Corruption can arise in any business in which money is apportioned or given out. In general, the question of financing state scientific centers is a serious one, and there are many problems causing headaches for the ministry. Though of course we were able to support the key institutes during the time of fall-off of orders, and this played an exceptionally positive role. Now, however, everything must be done to gradually get centers doing applied work to begin counting not only and not so much on the budget, since otherwise it simply couldn't survive.

[PRAVDA] Tell us please how expert evaluation of projects is done. How objective is it?

[Kozlov] When money is distributed, you have to persuade people that it is being spent sensibly. It is important here to make the process of selecting the projects transparent, and control over their resources should be open. I came to feel this back when I was working in the Institute of General Physics, and upon coming to the ministry I suggested organizing the Coordinating Council on Scientific-Technical Programs in Fundamental Physics and Astronomy, in which all major projects were discussed. The minister approved my idea, and we convened the council, which is staffed by around 30 persons specializing in different areas of physics, to include world-famous academicians—for example A. F. Andreyev, A. V. Gaponov-Grekhov and Yu. V. Prokhorov. The job of this council is to discuss both the programs and major projects currently underway, and newly proposed ones. The council has now been working 2 years already, and its experience shows that public discussion by competent, qualified people proceeds in a very respectful style and, at the same time, it does not allow anything doubtful to pass through its net. The moment itself of such a council is a very important factor. Now whenever we are asked to implement a certain project for a billion and a half, we say that we will bring it up before the Coordinating Council, and in many cases the matter doesn't go any farther—not everyone is ready to publicly discuss their projects.

In spring we requested reports from the chairmen of the councils on state scientific-technical programs on the work done, on the anticipated results, and on the needed resources. After making comparisons we will decide what to finance, and in what volume. An important distinguishing feature of the Coordinating Council is that it is unspecialized. In order to correctly determine the priorities, it is important to have a "broader" council.

[PRAVDA] Do you feel that the Coordinating Council will change the old practice from the period of stagnation, when an academician who had an "it" with elite got special support?

[Kozlov] I think so. When academicians propose major projects, the minister still recommends that they be reviewed by the Coordinating Council. After the council's approval the probability of a favorable decision is very

gress. And if a project is rejected, I'm certain that the rejecter won't go contrary to public opinion.

[PROGRESS] Do you feel that the prestige of science has been lost forever in the eyes of society and politicians?

[Kolesov] Things aren't as bad as all that. This year the competition for technical specialties grew tremendously. For example the competition in the physics faculty of the Moscow State University was three applicants to one seat. The statistics are the same for the Moscow Physical Technical Institute. Moreover everyone is also finding that the level of the applicants has risen. There are obviously several reasons for this. Living under our criminal form of capitalism is not easy, even if you make a lot of money. When you talk with businessmen who used to be scientists, you find that many dream of returning to science, building their own laboratory and returning to real work. This is a kind of guiding star and it is important to have one in your life. For the same reason parents are now wanting to give their children a education again.

Moreover it is interesting that good students have a possibility for continuing their education abroad. I direct a publically supported division in the RAN Institute of General Physics. I meet many young people, and I came to realize that if a person is the desire to study abroad, nothing should be placed in his way. On joining a foreign laboratory, he becomes our representative, and we establish permanent contact with the laboratory. Usually those who leave plan to return to Russia and continue working here, if the situation improves and they are able to provide for themselves materially.

[PROGRESS] Do you have any statistics on departures and returns?

[Kolesov] Nothing precise, but by rough estimate, fewer than 10 percent have gone abroad. However I wouldn't consider this country that is some laboratories our people already make up the majority, and Russian is becoming the working language, or estimate. But beyond that, everything will depend on us: if we fail to reform science, and let things develop on their own, it will take a long time for conditions to encourage our people to return to the motherland to establish themselves. If we surmount the difficulties—and I believe that we can—many will return, and we will even gain from the fact that they stuck with science and, moreover, acquired considerable experience abroad.

Now about the authority of science among politicians. Recently the Council of the Federation conducted hearings on national security, and many interesting ideas were voiced. First: The U.S. is drawn to be sensitive to role of world laboratory, and understanding that science is a more lucrative business, it is pursuing the corresponding purposeful policy. The second idea, stated by the deputy secretary of the Security Council, is that the future of Russia lies in preservation of its scientific potential. The role of science is gradually being realized even in these circles. This requires hope.

[PROGRESS] And now an almost rhetorical question. Do you feel that these reforms are directed only at keeping science from doing out, or are you still hopeful that it will develop?

[Kolesov] I would put it this way: to compete you energy and national of science would be strong. We need to think about the future at least a little. Society doesn't need science that is barely alive. Science must once again become a prestigious thing, it must attract the young—only then will it be able to survive.

Let there be lower scientific workers, but more results of a world level. The only kind of science we need is that of the first grade, the highest quality.

We must throw our scientific potential into the street. It has to be utilized effectively. Scientists are the elite of our society. It is no accident that scientific workers, especially physicists, are successful in business. We are losing our resources in science. Many scientific institutes in Moscow have essentially changed the nature of their activity. If scientific properties were utilized wisely, it could become a major item of income supporting the scientific sphere. We need to organize the possibility for establishing new organizations needed by science out of detail or doing institutes—such like industrial parks and business-starting organizations. The system of applied science doesn't have many important elements of the infrastructure at all. In order to implement scientific accomplishments we have to have marketing and consulting services, as analysis and forecasting group, patent protection, advertising, and product certification services, and so on. Soon we will be creating new buildings in which to accommodate all of this.

[PROGRESS] Do you feel that society's attitude toward science is an indicator of its level?

[Kolesov] Yes. On whole the scientific community also needs to consider itself very competently, many distract from many difficulties. For example, scientific programs have just begun returning to television. On the other hand astrological forecasts are given daily. People have gotten used to them, and even believe in them. And consider how many other pseudo-scientific programs there are on television. I can't blame society alone for the fact that it doesn't have much respect for science.

[PROGRESS] Please tell us about formation of the science budget for 1996.

SCIENCE AND TECHNOLOGY POLICY

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[illegible] scientific doctrine stating our position on these problems, as well as in regard to the means of organizing scientific research and utilizing its results, the volume of resources to be allocated to science, and the forms in which they are to be provided. Scientific doctrine is essentially a protocol of agreement between the scientific community and the society. It is a statement of what the scientific community hopes the role of science is, and what society wants from it. We have already discussed the draft of the doctrine with the government, and after it is adopted, a model legislative base for reorganizing science will finally come into being.

The [illegible] Science Ministry Draft S&T Doctrine

[illegible] *Moscow* [illegible] *in Russian Jan 96* No [illegible] pp [illegible]

[illegible] article: "Science Doctrine of Russia: Draft of Russian Federation Ministry of Science and Technical Policy"

[illegible] Translation Text: Guided by decisions of the government and recommendations of the President of Russia, the RF Ministry of Science and Technical Policy has prepared a draft "Science Doctrine of Russia," a document that sets forth the basic principles of mutual relations between the state and the scientific community during the period of carrying out reforms. The Science Ministry has published this draft in the daily newspaper [illegible], hoping for a lively and concerned discussion that will result in remodeling and refinement of the doctrine. The draft "Science Doctrine of Russia" was discussed in the Presidium of the Russian Academy of Sciences on 20 May 1995. The text of the discussion is given below with the remarks [illegible] the meeting of the Presidium of the Russian Academy of Sciences, and a revised version of the draft.

Science Doctrine of Russia

Draft of Russian Federation Ministry of Science and Technical Policy

Science doctrine is the system of views and principles shared by the Russian science community that define the main directions of advancement of the area of science and engineering in Russia during the period of reforms that will guide the higher agencies of state authority of the Russian Federation, supervisors and organizers of Russian science in their efforts to aid the development of science and engineering in the nation.

1. Russian science owes its years of existence to its made an enormous contribution to development of the nation and the world community. To a great extent, Russia owes its position as a great world power to the achievements of its scientists.

Under today's conditions, advancing in the natural sciences, the humanities and engineering is more and more becoming a source of the life of society, its spiritual and physical well-being.

The degree of development of science is a great extent determines the degree of protection of society from destructive natural and man-caused factors, the efficacy of economic activity, and the capability of a nation to defend itself. Modern society has achieved such a high level of interaction with equipment that its secure existence and stable development have become impossible without preservation and effective use of a major fraction of the accumulated scientific potential.

2. For years, our science was viewed not only as a major factor in social development, but also as an essential ingredient in the ideological struggle between two competitive systems. Its achievements were called upon to support the military might of the nation and to prove the superiority of the chosen state structure and to motivate, reward.

In accordance with this, a wide network of both fundamental and applied scientific research organizations was set up in the nation. There is no doubt that Soviet science was the world leader in many areas. This was achieved by mobilizing our science on enormous number of researchers, and by privileged funding of some areas of science, chiefly in defense. On the other hand, in many areas of civilian applied science the level of research and development was far short of world class. In this situation, the high degree of nationalization of science made it closed and isolated.

Today, the situation of Russian science is qualitatively changing. On the one hand, opportunities have opened up for really free scientific creativity, open exchange of information and extensive international cooperation, and, on the other hand, Russian science has run up against serious obstacles and economic problems. It is absolutely clear that science is going to have to be reorganized to adapt to the new conditions.

3. The present evolution of the world community is taking the path of expansion of collaboration and cooperation of states in the solution of global problems involving the investigation and preservation of the natural environment, maintaining human health, finding and mastering new sources of energy, studying matter and macromolecules, the conquest of outer space, expanding public access to information, and more.

The new strategy for development of science is sharply drawn. It gives priority to research that is significant for

[illegible]

[illegible]

[illegible]

—[illegible] state [illegible] [illegible] higher [illegible] that [illegible] of Russian science

—Arranging [illegible] and providing [illegible] for equitable participation of Russian scientists in international science projects [illegible] for Russia

—Arranging [illegible] scientists and public, science academies

5. A key element of the reformed system of scientific management is linking of the organizations of [illegible] funding [illegible] the following area

—providing a number of [illegible] funding for research and development

—concentrating [illegible] in priority areas of progress in science and engineering on the [illegible] a selective approach [illegible]

—[illegible] research equipment and [illegible] required, especially for [illegible] goods are imported [illegible] the case of what [illegible] of assistance provided to Russian scientific [illegible] organizations

—Arranging [illegible] additional money to science in the [illegible] fields, international organizations and private persons

—development of competitive mechanisms of the distribution of budgetary money

—ensuring that [illegible] will be public, [illegible] ensuring the scientific community is informed on the use of funds

• The need to develop [illegible] modern advances in science, to rejuvenate the Russian of the future and determining the rights and responsibilities of Russian scientists

Russian Academy of Sciences Discussion of Draft S&T Doctrine

[illegible] Moscow [illegible]

[illegible] Moscow. "The Kind of Doctrine That Will be Needed for Development of Science in Russia. Discussion of President of Russian Academy of Sciences

[illegible] Yesterday's opening the morning [illegible] of the Russian Academy of Sciences (RAS) [illegible] Yu. S. Osipov reported this document [illegible] the draft of the Science Doctrine of Russia was begun [illegible] the academy in April 1995. Comments and additions to the draft were solicited by all 15 [illegible] departments. The Siberian and Ural regional departments, and also the Samara, Dagestan, Kabardino-Balkarian and Bashkortostan centers. The range of opinions is rather broad, [illegible] all. This is sufficient to accept the case. Dr. Science and Scientific-Technical Policy [illegible] that a [illegible] to work [illegible] of the comments and additions, in the words of Yu. S. Osipov, have [illegible] the basis [illegible] development of the doctrine. The Ministry of Science and Technical Policy of Russia, [illegible] the academy [illegible] of the commission, the President of the RAS [illegible] discussion the draft of the doctrine [illegible] Taking part in the discussion were [illegible] the RF Ministry of Science and Technical Policy Minister [illegible] Salmin [illegible] the academy [illegible] Academician [illegible] Academician [illegible] Academician [illegible] Academician [illegible] Minister [illegible] Academician [illegible] Science Academy [illegible] the Minister of Science and Technical Policy [illegible] Yu. S. Osipov and A. M. Prokhorov, [illegible] and Minister of the RAS [illegible] Minister of the Council of the Duma Committee of Budget of the RAS [illegible] and academicians [illegible] Yu. Solovyev [illegible] Academician [illegible] Yu. F. Tarasenko and N. A. Vlasov

Details below will cause disagreements. The stenographic report of the discussion of academic doctrine held at the President of the RAS

A. A. Galushkin [illegible] the report of the [illegible] of the doctrine [illegible] the comments and additions that have come into the Presidium of the RAS [illegible] of North Russia [illegible] academic institutions on the draft. Customary regulations [illegible] comments and additions [illegible] 20 pages from departments, the ministries, the Siberian Department and also the Natural Sciences Section of the RAS. Having accumulated a large number of proposals, [illegible] summarized and systematized them [illegible] the President [illegible] Section. All comments and additions will be transferred to the RF Ministry of Science and Technical Policy in the form in which they were received by the Presidium of the RAS. We [illegible] and additions [illegible] requests from us, when the draft of the doctrine [illegible] discussion

The very title of the draft has been criticized, since the words "science" has a broad meaning. Attention has been called to the fact that the system of views expounded in the doctrine in one way or another is tied to the period of reforms. It is possible that the reforms will extend over a long period, but not the same; the doctrine should not be directly tied to a transitional period in the life of the state, since, in this case, the long-range prospects for development of Russian science and scientific-technical potential do not find reflection.

The greatest objections have been elicited by point 2 of the draft of the doctrine, which contains a historical analysis of the development of science in our nation. Acknowledging the undoubted achievements of Russian science, the developers of the draft attribute them to involvement of a large number of researchers, and to privileged funding of work primarily in defense. It is actually stated that science in the nation has developed extensively, redundantly, inefficiently, and thus lost its correspondence to reality. At the same time, in the last three or four years the position of the state with respect to science has been based on this flawed thesis. The draft also contains the opinion "... the high degree of militarization of science has resulted in its being closed and isolated." A statement of this kind applies to the nation as a whole and should not be said only to science.

The last paragraph of point 2 of the doctrine has prompted particular criticism. This section talks about the qualitative change in the situation of Russian science at the present time: "On the one hand, opportunities have opened up for really free scientific creativity ... and on the other, Russian science has come up against serious financial and economic problems." Let me point out that freedom of scientific creativity existed formerly as well: a scientist could devote himself to any problem, but if he wanted to be supported, he had better do so for [illegible]. With regard to the funding difficulties that science has encountered today, the developers of the draft suggest that rather than overcoming them, we should adapt to them. At the same time, everyone knows quite well that in recent years Russian science has felt blows both from the state and from the government. Science cannot be maintained in the situation where it now finds itself—such is the opinion of the academic community. The state and the government should remove the current financial and economic difficulties of science, rather than calling upon science to adapt.

There are several specific comments on points 3-7. In particular, direct state support of science is mentioned only once in point 4: "... direct state support shall be provided chiefly for those socially significant areas of science that are not adequately supported by non-governmental investors." In our opinion, there should be a more definite statement of how fundamental science is to be supported, and in what way science as a whole will [illegible] the market system. Academy representatives state that the doctrine should indicate the role of fundamental science as the basis of knowledge and applied research.

The legal content of the doctrine is set forth in points 6-7. There have been many comments regarding the order in which the principles of organization of scientific research in reformed Russia are presented (point 6). Everything begins with assurance of freedom of scientific creativity, including selection of topic, methods of study and avenues of funding. Next comes securing the rights to intellectual property, unimpeded access to open information, and only after this, commitment to enrichment of fundamental research.

Something [illegible] should be said about providing for an adequate [illegible] of [illegible]. Let me point out that in the time before [illegible], according to the opinion of the developers of the doctrine, [illegible] was virtually [illegible] with ideology and the military, but was developing successfully because the leadership of the nation was effectively dealing with science-related problems [illegible]. When I was informed that [illegible] should be created, the same principle [illegible] science [illegible]. I [illegible] working in [illegible]. At [illegible] the [illegible] the leadership of the [illegible] science as a whole was raised to a higher level of development, which has its impact on the [illegible] as well. And now the doctrine proposes [illegible] state support of science.

I am mentioning this matter [illegible] the doctrine might have been well received in the scientific community in 1990 or 1991, when the nation was at the threshold of the reforms. But now, when science stands between crisis and catastrophe, there is a lot that needs to be changed in the doctrine. It should reflect the current situation and specific measures for improving it.

A. V. Sporov: Andrey [illegible] has evaluated [illegible] of the doctrine, and has looked in particular detail at the first part, which [illegible]. There is one proposal. In its present form, the doctrine is [illegible]. All that is needed for scientists is contained in section "7. Point 7" begins with the words "The state treats science as national property ..." These are the words that should have started the doctrine. I suggest that the first six points of the doctrine be dropped entirely, with the concluding points 7-11 of the doctrine, and then it be approved.

Yu. S. Osipov: I want to say that the time for the discussion of the draft [illegible] bringing [illegible]

[illegible] progress. Besides, there have been some serious comments regarding points 7 and 8 as well.

D. G. Rosov: I regard point 2 of the doctrine as very problematic. A lot is said here due to general anti-regard to the past of science. I mean not the fundamental science to "spread up" in the first six points of the doctrine. If they are kept, then the problem of fundamental science will have to be clearly formulated, and there will have to be a plan of what is to be done in this area. Almost ten years ago, academicians were already doing such work.

I might be that it is time for us to stop playing with words about branches of scientific knowledge, demarcation of science and its state support. After all, there is really nothing behind these words. Judge for yourself: the doctrine speaks of the right of free selection of a research topic, and in the same time about state support. I think we say that to recognize science after Lomonosov Academy from the beginning, as developed, dominated, administered and it, [illegible] which never they worked within the limits of the [illegible] concerned to the field of knowledge. It is necessary to propagate to talk about development of science in the conditions when it has to support from the hand and private funds. It seems to me that provisions of the doctrine stipulating a transition to market and democratic relations ought to be dropped to [illegible] contradictions, [illegible] contradictions.

N. A. Sklo: I wanted to say that Russia needs a science doctrine. This document must rely on the following two fundamental provisions: maintaining and enabling role of the state in the development of the world community, [illegible] of natural resources of the nation, [illegible] scientists, and I might add — educational potential, [illegible] of the geopolitical position of Russia.

I think that the doctrine ought not to forget the provisions of science. If today we declare as a priority any other scientific direction or an undergraduate student by seemingly important, and we forget the corresponding factors that developing it, we might be mistaken and cross down scientific research in other areas for years. A clear-cut investigation of the role of carbon dioxide in the evolution of the universe throughout was considered priority and we cut back, but in some other countries as well. Now the priority of the direction is acknowledged as erroneous. The list of similar examples could be extended.

With regard to the specific content of the science doctrine, I subscribe to Aleksandr Sergeyevich Ignatov's opinion about keeping only points 1, 4, and 5.

L. D. Faddeev: The department of mathematics feels that the submitted draft cannot serve as the basis for a doctrine of development of science in Russia. In its criticism, contains a [illegible] and good wishes. We gave our vision about what science is, why it is needed by the state and society. I will give you some specific comments. Point 1 draws a new strategy for the development of science that gives priority to research that is significant for all mankind. This reflects a trend that is current in today's world. This is the attitude toward science in the United States and European nations. But this trend is extremely dangerous as it downgrades the role of fundamental research, and gives preference to developments that have some immediate benefit. It seems to me that in today's difficult situation we will not preserve fundamental science if we take this road.

It seems that the doctrine should be realistic and should include the following basic principles: science as the aggregate of knowledge, methods and means of research; the world significance of fundamental science as international character; the national interests of Russia, mutual relations between fundamental and applied research; the role of the state in regulating science.

V. A. Sadovnichiy: In our opinion, we have been [illegible] to be a great power in science. This is an necessity, which is acknowledged throughout the world. And it seems to me that we sometimes have delayed for we have caught up with otherwise, and have proclaimed something like that is our scientific doctrine. At the same time, the doctrine has to reflect the true state of affairs in science. The fact that Russia [illegible] the necessity with a great power in science [illegible] suggest that the doctrine itself should be realistic and contain the two contradictory principles that have already been mentioned. The role of science and education in ensuring the role of the state in their development, and therefore it effectively suggest that the state participate in implement.

[illegible] of [illegible] component of the science doctrine of Russia: fundamental education. The 2nd half year in the academic hall of Moscow State University there was a graduation ceremony of honors students — there were about 400 of them here. Of the 300, who have been educated at Moscow University only 25 percent, and perhaps fewer, will go to work in science and [illegible] percent are graduating to investment. And there are not graduates of other ordinary colleges. This are the lower medium of the nation's consumers and the [illegible] consumers of us then who should be doing science in Russia. Fundamental education is being discredited in our nation, and with we underestimate the attitude of today's society toward science and education, primarily by means of the doctrine that we are now discussing, we will not be making any good scientific breakthroughs.

Zh. I. Alferov: I support the proposal of Academician Sagdeyevich figures. Only the first last points of the draft of the science doctrine are worth discussing.

With regard to the necessity of creating such a document, my comment is: we can invent any kind of doctrine about science. But it will not 'work' until there is a working concept of development of the nation's economy. Without a developed economy based on high-tech industrial technologies, science is going to die out anyway. We have already lost the guidelines of scientific developments — our industry — and we are bound to give up our best developments to the West.

Yu. P. Velikhov: I believe that some reasonable doctrine of development of the nation will somehow be adopted. In such an event, do we need a doctrine on science? And who should this doctrine be: some committee of the scientific community, or a document of state agencies? If the former option is preferable, then a wider group of scientists should have been involved in writing the doctrine from the outset, rather than now reworking a document that has come from the heart of a minority.

Now let me tell you what I think about the essence of this draft. Since the doctrine contains an analysis of the previous history of development of the nation, I believe it should be mentioned that science has not only funding, but connection to a government that represents society. The public lacks understanding of the role of science and the importance of utilization of its results in the national economy. Science was highly esteemed in the past. For example, there were two vice-chairs in the government, one who answered directly for the state of science in the nation, and the other — the chairman. The military-industrial complex did a lot for science. This commission held weekly discussions of the problems of high-tech industrial technologies, and usually looked at the state of fundamental research. Today there are no such people in the government.

To come up with a reasonable concept of the development of science in the nation, we have to have an idea about what the relation between the government and science must be under today's conditions. And incidentally, the State Duma is a government agency. The U.S. Congress considers all significant science projects, and so the natural question is: should our Duma do the same? So far it is giving attention only to space research. I suggest that the doctrine should reflect problems of science management, reinforcement of the connection between science and government agencies.

Our nation's budget is now based on a tax system. Everyone knows full well how taxes are collected in our country, and consequently science cannot count on normal funding for the next few years. To be normally funded, the science community has to solve problems of property. In hard times that will stretch out for decades, rather than for years, property will help us to survive. There was a time when such a concept as corporative property was dropped from our legislation for purely political considerations. As the saying goes, all U.S. universities own property on a corporate basis. If such an opportunity were offered to our science institutions, they would resolve many economic problems.

A few words about freedom of creative activity. It is one thing to proclaim it, and quite another to provide a mechanism for putting it into effect. I have tried to propose such a tool, though perhaps not very successfully. I believe that large science centers should have independent cells where science would develop freely, as in the departments of U.S. universities. At Kurchatov Institute such cells have been named universal laboratories. It is my conviction that these cells should not be commercialized, as business-like science. Nor can they be public organizations. A special niche must be found for them.

I think that of the points I have brought up do not find reflection in the doctrine of science development. The document will be transformed to a declaration that would fit on half a page. But there is no need to spare paper for a new doctrine. It ought to include all sensible ideas.

V. I. Subbotin: It seems to me that we ought to thank the Ministry of Science and Technical Policy for the initiative that they have shown in preparing the draft of the doctrine. It is my view that it should reflect the opinion of the science community on ways to develop science in the nation. It is desirable that the document not be very large.

Let me make some specific comments. First of all, we must not forget that a lot was done in the past to bring up the caught of our nation. Of course, the past was not ideal, just as our present is not ideal. Secondly, those who have really had to deal with classified work know the secrecy in the United States was no less than here, and perhaps greater. In the third place, I believe that we must remember that the demands of the military are essentially what has moved science forward all over the world. Had they not pushed their demands, we might not have had nuclear physics, radio chemistry, and lots of new materials, as it takes huge amounts of money and the concentrated effort of large teams to develop these fields.

V. A. Mansurov: I am skeptical of all doctrines, however, the concept of science development in the nation is necessary. We only a concept with a law

on science. Without such a law to provide a legal foundation for the development of science, the doctrine is nothing but a scrap of paper.

The doctrine should contain a point about reorganization of science. This is a process going on now throughout the world, including in the United States. And incidentally, state deliveries for fundamental science have increased, rather than decreased in the United States, and deliveries for applied science are growing with funding from companies.

I agree with the proposal already expressed at this meeting regarding giving greater emphasis in the doctrine to development of fundamental science and, of course, all sciences. The list of global problems being dealt with by the world community does not mention education. Though it is of no less importance than public health concerns for the needs of people, and so on. The doctrine should certainly contain an objective assessment of the current position of science and specific measures for improving it.

V. N. Baldyrganov: I share Andrey Aleksandrovich Gonchar's view that the title "Science Doctrine of Russia" is inappropriate. It is ambiguous, and ought to be changed. But it is more important, in my opinion, to determine to what relation the doctrine should stand to the law on science. Right now, the State Duma is discussing a bill "On Science and Scientific-Technical Policy" that contains roughly half the points mentioned in the doctrine, in particular, the principles of state organization and funding of science are written into this bill. It would seem to me that the doctrine should not bring up the same issues. Anyway, the draft of the "Science Doctrine of Russia" talks not so much about science itself, as about its organizational support. It is subjects around science that are dealt with. The proposed document does not go into the content of scientific activity, does not tell us what science should do for society, and what society expects from science. I believe that the doctrine should include a point about scientific priorities as well.

I don't like Andrey Aleksandrovich Gonchar has rightly formulated the issue of the document, reducing the scope of work on science. As the proverb has it: "Cut one coat after the cloth." This issue permeates point 2, where the history of our science is mentioned, especially in last paragraph that counts science toward adaptation to the new economic conditions, point 4, confirming that direct state support is to be provided only in those cases where there is no private support, point 6, which proposes that resources be concentrated "in priority areas of progress in science and engineering, for the purpose of ensuring a selective approach to state support." A policy like this will destroy science. I feel that the tenor of the doctrine should be changed. Estimates Russian science has to be reviewed.

The draft of the doctrine has spoken nothing to say about research in the "humanities." It is mentioned that we should not forget about the spiritual life of society, that in the past the humanities were developed. This can remark is quite true. But now they must be developed, one cannot be indifferent to them or worse than, of.

I. M. Makarov: I do not know of a single country that has ever published a document like the one we are now discussing. My comments on the text of the document totally boil down to the following.

I think that a doctrine of development of science should not be presented without basic principles, provisions and goals that are ultimately to be attained. The document must be tied to the concept of socioeconomic development of the nation. The submitted document is not clear enough in characterizing Russia's need for science, and therefore inadequate measures are proposed for its development. The doctrine should especially stress the responsibility of the state for the status of fundamental science, research and development. I agree with those who have spoken: the text of the doctrine does not reflect or does measure the issues of education in the humanities.

I suggest that the Ministry of Science and Technical Policy has acted properly in working up the document and offering it for wide discussion. As a result, a serious discussion arose to determine whether this need such a document, and, if they do, what it will have to be like.

Ye. P. Chelyshev: I am quite satisfied that the ministry has worked out, albeit not yet perfectly, a plan for the development of science in our nation. I would suggest that the following changes be made in the document.

It is underscored that the title of the document is very much open to criticism from the linguistic standpoint. Perhaps the title should be "Science in Russia: Status and Prospects for Development." Points 1-7 must be radically reworked. There should not be unsupported declarations, imaginary or real shortcomings that existed during the years of Soviet power. During that same period, unique schools of science evolved and world class results were obtained. The doctrine should accurately characterize the status of our science, and reflect the concerns of scientists about its future. Tasks of fundamental and applied science, the particulars of their organization and financial support, must be clearly determined. It is mandatory that science be taken of the enormous role of the humanities in bearing the nation and the representative of Russia. I agree with Viktor Aleksandrovich

[illegible] that issues of education, as organic connection with fundamental science, should be concentrated in a single point of this document.

A. M. Dubinov: I want to raise attention to the danger of supporting very promising scientific areas. Before the war, as we know, nuclear physics was not considered promising, nevertheless the Academy of Sciences supported research in this field, especially radiochemistry. Thanks to this support, when the Academy of Sciences had nuclear specialists, who in short order produced the atomic and hydrogen bombs, and later developed nuclear power. Examples like this can be cited for other fields of knowledge as well.

With regard to education, at my point our specialists who were graduated from our academic institutions to this day are highly appreciated in the United States and are often invited there to give lectures or for permanent jobs. Moreover, now it has turned out that our educational system is good, and we are being told to copy the U.S. system. Let me remind you of the words of a well-known politician: we want to do it better and it turns out like always.

M. A. Sadovsnik-Alexandrovich: It seems to me that some changes need to be made in the draft of the doctrine. First of all, one cannot set off fundamental science against applied science. One serves as the foundation upon which the knowledge of the other is erected. Knowledge without a foundation is as bad as a foundation without knowledge.

Secondly, the creators of the doctrine have suggested about goal-directed fundamental research, which alone can lead to original applied developments. Other wise fundamental science, as Lev Aleksandrovich Artsimovich said to his day, will merely satisfy the curiosity of scientists at the expense of the state.

In the third place, science has become a very expensive occupation, and there is not much money in our nation. Of course, funding will take into consideration what society will stimulate, i.e. get out of science. And hence we need a clear concept of priorities, which we completely lack. After all, over the past decade all notions about the future evolution of civilization have changed. I will demonstrate this by the example of power engineering. Not long ago it was assumed that in the near future conventional energy sources would run out, but now it is absolutely clear that they will last for any foreseeable period of development of civilization. The most ecologically clean of these resources is nature gas, with which God has generously endowed our nation.

And finally, it seems to me important to coordinate economics with science, with any area of science, and especially with power engineering. Doing this is complicated, but necessary.

V. M. Gvozdi: My two comments on the draft of the document we are discussing relate to its preamble. I begin. The science doctrine of Russia is the system of views and principles shared by the Russian science community ... and ends with the assertion that these views and principles will guide authorities in their efforts to aid the development of science and engineering in the nation. It seems to me that since the goals of the document are defined in the preamble, it should formulate the unanimity of the views of the scientific community and the authorities, the understanding by the latter of the tasks facing science. Let me give an example to demonstrate the necessity of forming this kind of commonality of views.

An article by Professor Rakitov, one of the advisers to presidential structures, has been published in the journal VOPROSY FILOSOFII. This article states that science was forcibly introduced into Russia by Peter I, to this day, no cultural layer of the population has been formed, the Russian people have still not grown up to the level of perception of scientific advances and therefore we have a marginality of science. Let the views that this is the opinion not of an ordinary professor, but, by an adviser to presidential structures.

My second comment relates to point 8. It seems to me that it is in particular and excessively detailed. I believe that the necessity of creating a favorable economic environment for the development of science and scientific-technical progress should have been formulated in general words.

And finally, I support Vladimir Nikolayevich Kudryavtsev's opinion about the relation of the doctrine to the law on science.

V. Ye. Sokolov: Although the document submitted for discussion contains a lot that is interesting, it is still not clear for whom it has been written, and whether higher agencies of authority will be guided by it. I personally, as an organizer of science, will not be able to be guided by the provisions of this doctrine. After all, if I, as national director, am not given funds, I will be unable to stimulate the development of leading schools of science of the institute. I think that the existence of a document of this kind in qualified form of it is to be the basis of a future law on science.

P. V. Simonov: Might somebody here present will explain the relation between the Law "On Science and Scientific-Technical Policy" being discussed in the State Duma and the document entitled "Science Doctrine of Russia"?

Yu. S. Osipov: I hope that Boris Georgievich Saltykov will answer this question in his presentation.

L. V. Sedov: It seems to me that it is extremely important to understand the status of the document under discussion, and why it was written.

I agree with Igor Nikolaevich Mironov, in that world politics probably has not encountered a document of this kind. It can be treated (and many do so) this as a declaration of union that is being concluded between the scientific community and the government of the state. However, such a document will most likely be a law about science. The document should probably be a joint declaration of the scientific community and the government that is addressed to society. The thing is that up until now we have been thinking that the relations have to be set right with the government, it will give us money, and everything will be fine. But the government gives money with the consent of the Duma, which reflects the opinion of society. And many deputies of the Duma, who can be away from science as well as many ordinary citizens ask themselves: What do I need with science anyway? Therefore, the document that we are discussing now (it is needed, of which I am not certain) should be a joint declaration of the state and of the scientific community to the effect that science is necessary, and why it is necessary. In principle, the proposed text is up to the task. Though I have some specific comments regarding it.

G. B. Sarapin: I will try to answer the question of why we need the document being discussed. It should be either a program for many years of science development ratified by parliament. The Law "On Science and Scientific-Technical Policy" must deal with how to develop science. Thus, the doctrine and the law are totally different documents. Otherwise, why use the term "doctrine" in the military. There are three levels in the chain of decision making: doctrine, directive and order. In some sense, the levels of organization of science are doctrine, [illegible] corresponding documents. Attempting to mix these levels in a single document may prove fatal.

A. G. Aganbegyan: It is my view that the doctrine should determine the course of development of science, serve as a basis for working out other documents relating to science and scientific activity, including the law on science. The doctrine should not be reduced to a declaration, as it has strategic significance.

The doctrine should have a clear-cut audience: it is addressed to the state and to society. It should disclose the meaning of science in the life of society, its place and role in the system of the state, basic trends and principles. It seems to me that the doctrine must not be predictive, where our society is going and what its goals are. The doctrine should not be adapted to the circumstances in which we now find ourselves — very difficult and complicated. After all, much of what is taking place in our country does not exist from the inner laws of our social life.

I feel that the sharply negative attitude toward the part of our science that is contained in the doctrine is unjustified. In particular, the military-industrial complex, that supports development of many science areas has worked for the needs not only of defense, but also of the national economy. Also disgraceful is the recent translation of a selective approach to science funding. We must think about the future. It is not the interface of different areas of science that especially many discoveries take place.

B. G. Saltykov: First of all, thanks for giving me the opportunity of taking part in this discussion. And right off I want to respond to Yevgeniy Pavlovich Velikhov's comment to the effect that a science doctrine should not be prepared in the heat of a minority. No, we intended to do this in the heat of the minority, which doesn't need a answer. The doctrine, if it is needed by the scientific community and the state, must be the result of activity of the community itself. The minority has already achieved everything it set out to do. It put this task to paper and initiated the discussion. However, the question remains: is a document needed? Doctrine needed, or not.

It is difficult to define the genre and scope of this document. And today's discussion has revealed polar opinions. Some think that the text of the doctrine can be reduced to the last three points, and others call for not sparing paper in a noble cause. So we are all in a quandary: we don't know how this kind of document should be constructed.

Can we make it written, a written doctrine? Of course we can. But a doctrine does exist, written or unwritten. It is the sum total of views that regulate the relations of the scientific community with the authorities and with society as a whole. If we talk about the doctrine of Soviet science, it was characterized by factors that were inherent in Soviet society such as being closed, militarization, a labor-intensive path of development, an isolation research from. This is stated in the text of the doctrine. For example, in 1987 three fourths of the science budget went for defense research. U.S. science was not so militarized, while in Germany and Japan a fraction of a percent of the science budget was spent for defense research. The state, based on a strategy of self-development and mutual relations with the world, decides whether it needs militarized or non-militarized science. As I said, the doctrine simply states

[illegible] and does not give an assessment of whether this is good or bad. Incidentally, there was something good in [illegible] science. The concentration of resources and scientific potential on priority areas of science and engineering, or on handling strategic problems, enabled attainment of success, including in fundamental fields of knowledge.

I agree with Lavrent Vasilyevich Keldysh's definition of the purpose of the document that we are discussing. It is actually a declaration of intent of the authorities and the scientific community (or community of the scientific community) and the authorities addressed to society. We want to tell society about the role and place of science in the Russian state not just now, but in the future. We want to show that Russia as a state without science is unthinkable, all of its elite is concentrated in the sphere of science, not just fundamental but also industrial and academic science. At the same time, the doctrine formulates the governmental obligations of the state with respect to the scientific community. It seems to me that the creation of such a document will [illegible] harm to the development of [illegible] science.

To the former, the development of the doctrine was [illegible] guided by purely opportunistic considerations. That is why the document contains such things as "at least from payment of concrete and taxes" or expansion of funding "amounting to at least 1 percent of the expenditure part of the budget." Comrades, [illegible] this should be excluded.

Let me also say something about historical judgments. This document can do without them. Not if historical judgments are to be introduced, they should be reasoned, considered, and not suggestive. I am sick of those who feel that everything in Soviet science was bad. Science cannot develop in isolation from society. In the past it was a part of the administrative-command system, and if we have now turned away from the former concept of development of society, science must change. This means that the administrative and departmental system of distributing resources has to be replaced by free selection of funding sources. Multiplicity of these sources is a condition that gives scientists autonomy. Freedom: that is a fact that cannot be denied. Of course, we have our own traditions of science funding, which is something that has hardly been mentioned here. What I mean is support of the leading schools of science, the elite one of which Russian science has sprung, and in which it has always been strong.

I agree that the problem of young scientists is best, as it seems, on the tail of the document. It should have been shown that science is one of the best places for investment of talent. But I would not have an arithmetic suggestion as opposed to higher educational institutions where the fact that three fourths of the best university graduates have not been placed. Placement does not at itself guarantee that the graduate will be well placed. At one time there were many who were strong [illegible] three fourths of the placement sources, [illegible] world somewhere else, but they were not granted that right. Nowadays, when the world is a totally free one, and we [illegible] that we can do [illegible] well. Our task is to balance the number of institutions [illegible] with respect to supply and demand. The college senior should generally know where he is going to work, and should be sure that he will be hired there.

A little world-wide scientific information. There were a few comments, serious as well, and we determined by the [illegible] of development of science itself. We can [illegible] scientists either to [illegible] or to mathematicians, where they are going to work on. The problem of [illegible] scientists arises when handing a thing allocated [illegible] of the [illegible] sector. [illegible] Soviet living situation [illegible] scientist should not be satisfied. I do not [illegible] the idea [illegible] engineering or [illegible] fundamental research from [illegible] indicators [illegible] a small [illegible] obligation to support [illegible] science or another. It [illegible] be implemented [illegible] that it will be given some [illegible] of fundamental science, with fulfillment of the assignment rather [illegible] being given [illegible] handling an accumulation of something [illegible] science. Scientists must [illegible] the [illegible] society with science [illegible] society.

I [illegible] accept the specific [illegible] to the draft [illegible] the document. I believe that [illegible] to verify [illegible] document [illegible] this [illegible]. We have not taken the [illegible] which [illegible] to [illegible] comments.

V. G. [illegible]: Science is running out [illegible] generation [illegible] and we are not training the new generation, as the percentage of science [illegible] is [illegible]. And to the [illegible] a single word is said about this in the document.

B. G. [illegible]: [illegible] the [illegible] I would say the document [illegible] of science [illegible] that is not in the document. It is [illegible] to adequately [illegible] science [illegible] a [illegible] document.

I would not make the emphasis with regard to training [illegible] young specialists in universities. A major increase has been [illegible] to universities in colleges of economics, medicine and law. There was a time for science [illegible] to universities to [illegible] colleges and the [illegible] science departments of universities. Of course, what we can train there does not [illegible] to attract the young specialists to academic institutes. We have to [illegible] special issues of supporting young scientists. But as I said, the concentration of our efforts and the emphasis [illegible] document.

N. P. Lavrenov: [illegible]

First of all, [illegible] the Ministry of Science and Technical Policy [illegible] a science function. This would mean that the Ministry is completely unprepared to put concept of the development of science in our country. At the same time, by stipulating in [illegible] that [illegible] function needs to be developed, the government has taken upon itself certain obligations toward the scientific community, the state and the people in developing and maintaining science. Analysts we have caught [illegible] the government with [illegible] in developing a science function [illegible] in the development of science.

Secondly, [illegible] of development of [illegible] administration. [illegible] concept that fundamental [illegible] applied areas and [illegible].

In the third place, [illegible] foreign science. This should be studied from the standpoint the public [illegible]. The [illegible] computers produced as result of the services of the high tech goods of the national economy [illegible] computers, [illegible] machines and refrigerators. [illegible] the nuclear industry [illegible] produced for the people. There were examples of the national economy, medical instruments, machines for mining and processing materials and [illegible].

Fourth, [illegible] was part of a market, and [illegible] different markets, science should also be different. But the market is far [illegible] of the new reports [illegible] market. We have been [illegible] made by means of [illegible] director. I can now make [illegible] I would have to close the factories of the Ministry [illegible] our best developments to people and [illegible] equipment for dollars in order to maintain leading schools of science. Personally, I believe science will be something [illegible] Zhukovskiy Academy [illegible] St. Petersburg Physicotechnical Institute [illegible] a free science will be nothing [illegible].

Let me say something about the [illegible] simply disappointed by the news that 70 percent of the best Moscow University graduates have no plans to [illegible] research in the sciences. 24 graduates from the two top Moscow institutions of higher learning, the Engineering Physics Institute and Moscow University, [illegible] graduate [illegible] there, scientists are [illegible]. This just did not use the [illegible].

[illegible] where the [illegible] structure. The [illegible] of this year. The pay of the workers in science was higher than average for industry in 1990, the average pay in science was 300 rubles and in industry it was 250. Additionally, it is stated that 70 percent of the average pay is a bonus in science and 30 percent of the average pay is a bonus worker in industry.

Getting back to the concept of development [illegible] of the points for this to happen is to Russia's interest in this approach. [illegible] governments and the legislature [illegible] the State Duma [illegible] will require a [illegible] further developing the scientific-technical potential [illegible] to influencing them in the business [illegible] and [illegible] obligations.

Yu. S. Osipov: [illegible] the [illegible] the [illegible] commission. Nevertheless, science in Russia has always been a state matter, and as long as [illegible] the position of scientific development is going to have [illegible] reflect the interests of the state. I must describe the role and place of scientists in the state that relates to which the state is obligated to support science from [illegible]. [illegible] and what scientist takes place in the state if science [illegible] the field and in the direction of scientific development we need, in view of scientific research [illegible].

It has lately been proposed that the [illegible] problem. [illegible] The scientists [illegible] discussions there. [illegible] Russia's [illegible] investigations of scientists for funding of research and development. With regard to experimental design and applied research, this is the proper communication of the [illegible] scientists have [illegible] the [illegible] business scientist in another sector. The [illegible] a state document, [illegible] research. With multiple funding sources for state [illegible] regulation. In state regulation is possible without landmark. But landmark problems which control and activation of processes. Now, [illegible] the example, the problem of mathematics. In state [illegible] further further who will be doing what. [illegible] that is, that is the former state [illegible] mathematicians who had nothing to do with [illegible] what I wanted to [illegible] science.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Afterword

[illegible]

Russian Draft Doctrine — Development of Russian Science

[illegible]

[illegible]

[illegible]

Doctrine of Development of Russian Science (Draft)

[illegible]

I. Science Is a Crucial National Resource of Development Russia

[illegible]

research organizations was set up in the nation. Soviet science was the world leader in many areas. This was achieved by recruiting into science an enormous number of researchers, and also by a high level of budgetary funding. However, the high degree of militarization of scientific research, unjustified limitations on freedom of creativity and the rights of intellectual property delayed development and effective use of the nation's scientific potential.

Today, the situation of Russian science might be qualitatively changing with consideration of new trends in the development of world science of the twenty-first century, where opportunities have opened up for free scientific creativity, open exchange of information and extensive international cooperation. However, the transitional period of sociopolitical restructuring in the Russian Federation has put Russian science into serious difficulties: extremely inadequate budgetary funding is complicating state regulation in the sphere of science, timely renewal of the material and technical base for research and for creating normal working and living conditions for scientists is not being provided. The prestige of the scientist's profession has fallen in society to an unprecedently low level and has become unattractive for talented young people. It is abundantly clear that science is going to have to be reorganized to adapt to the new conditions by attracting additional sources of funding and by more effective use of research results.

3. Current trends in evolution of the world community are taking the path of expansion of collaboration and cooperation of states in the solution of global problems involving preservation of the natural environment, providing for an adequate spiritual and physical human standard of living, maintaining the health of every person, population and ethnic group, finding and using new sources of energy, the conquest of outer space, providing information to society, and more. The new strategy for development of science gives priority to research that is significant for the very prospect of existence of the world community, for the stable and secure development of that community.

4. However, the trend toward integration of the world community does not mean that national interests will vanish, including in the sphere of science. Moreover, the national science product will to a great extent determine the capabilities of the nation for solving its internal problems, its place in the world community, and the outlook for competing in foreign markets.

The scale and pace of development of Russian science must ensure that the potential of Russia is in accord with the level of world progress in science and engineering. Its priority areas will also be determined by the economic and geopolitical position of Russia, the global significance of its natural resources, the needs of spiritual and material development of our society, and the humanist traditions of Russian science with regard to world trends of the transformation of civilization at the turn of the millennium.

5. Exceptionally important for real transformation of life in Russia as a whole is a course of development of science in outlying regions that is conducive to their progress with consideration of distinctive economic, resource, ecological and cultural features.

II. Development of the Scientific Potential of Russia

1. The state looks at science as national property that determines the future of the nation, and considers its support and development to be a priority task. Without powerful science that is operating effectively, without enlightenment and education of the people based on fundamental knowledge, there can be no great Russia. Among the crucial principles of state science policy are:

—support by our own potential in the development of Russian society;

—stimulating the development of fundamental research;

—preserving and developing leading Russian schools of science;

—bringing about conditions for healthy competition and business enterprise in the area of applied science and engineering, stimulating and defending innovational activity;

—that taking science with education, developing an integral system for training skilled personnel on all levels;

—freedom of scientific creativity, consistent democratization of the scientific sphere, promoting openness and publicity in formulating and implementing science policy;

—protecting the rights of intellectual property of researchers, organizations and the state for results of scientific activity;

—establishing research and development organizations with different forms of property, including small businesses;

—promoting conditions for extensive use of advances in science, aiding the proliferation of innovations in science and engineering that are key to the Russian technological infrastructure;

—raising the level of prestige of work in science, bringing about adequate conditions for the life and work of scientists and specialists.

—spreading the word about the latest advances in science, its significance for the future of Russia, protecting the rights and interests of Russian scientists.

2. A key element of the reformed system of science management is coming to be improvement of mechanisms of funding, price formation and tax policy in the following areas:

—setting aside allocations in the federal budget for funding civilian research and development in an amount of at least 3 percent of the expendable part of the budget with an annual increase as the economy stabilizes to the level of developed nations;

—providing basic budgetary funding for the Russian Academy of Sciences, the Russian Academy of Medical Sciences, the Russian Academy of Agricultural Sciences, the Russian Academy of Architecture and Construction Sciences, state science organizations and centers that work in priority areas of science and engineering, state universities, leading institutions of higher learning, science libraries, museums and information centers;

—providing multiple sources of funding for research and development and research targeting, bringing about favorable conditions for investing money in science on the part of industry, banks, international organizations and private persons;

—development of competitive principles in the distribution of money through state funds (Russian Fundamental Research Fund, Russian Fund for the Humanities, Fund for Aid to Development of Small Businesses in the Sphere of Science, and others) with open discussion of decisions and involvement of the scientific community in monitoring the use of funds;

—stage-by-stage introduction of a federal contract system in the area of research, teaching, science, engineering, and experimental design;

—introducing a set of customs and tax privileges to support activity in science;

—bringing about conditions and providing the necessary resources for participation of Russian scientists in international science programs;

—promoting activities of public science associations, academies, scientific societies, and so on.

The state, in taking upon itself the listed obligations, expresses assurance that the Russian scientific community will provide the necessary scientific-technical prerequisites for transforming Russia to a humanist lawful society with high spiritual standard of living based on material, economic and technological stability, ecological safety and military security.

Russian Science Minister Reviews Year (1995)

MINNAUKA, Moscow POISK in Russian 10-16 Feb 96, p 1

[Article by Oleg Lozin: "Today is Worse Than Yesterday"]

[FBIS Translated Text] The board of the RF Ministry of Science and Technical Policy [MINNAUKA] has summed up the main results of ministry operations for 1995, and defined the tasks for 1996. Minister Boris Saltykov, who delivered the main report, had to make it clear that at this time the sphere entrusted to him, due to lack of funding, is going through the most severe crisis in the past four years, and that he would talk about the situation as it stood at the end of the year, i.e., prior to the financial collapse.

The theme of the minister's speech was that the year had not been spent to no avail. A lot was done, and Boris Georgyevich had quite specific figures to give on the account. The operations of MINNAUKA last year were determined to a great extent by the government's statute "On State Support of the Development of Science and of Projects in Science and Engineering." The ministry has satisfied 12 of its points, work is continuing on seven of them, one has been dropped, and two have yet to be met.

B. Saltykov summed up the main results of the year as follows:

"In my view, we can consider the first stage completed in setting up the normative-legal basis of state science and engineering policy. Albeit with some degree of caution, still it can likewise be said that we have solved the problem of coordinating the operations of federal agencies of authority that determine and carry out this policy. The only exception here is the area of dual technologies: there is still work to be done on achieving better organized operations in this field. A mechanism for target funding has been basically worked out, and a system of alternative sources of support for science and engineering is in place. We have eliminated monopolism in the distribution of monetary resources and have provided for more effective use of these resources by introducing the 'point' competitive principle of financing. The spirit of enterprise is evolving in the field of science and engineering. Measures that have been taken are conducive to maintaining the core of science and creating components of a market infrastructure in innovative activity. Moreover, we can freely state that Russian science has become less militarized and more open.

B. Saltykov's general, so to speak, political conclusions were supplemented by a talk about specific achievements.

Work has been completed in the ministry on a list of priority areas of development of science and engineering. It has been submitted to the governmental commission on science and engineering policy. This list looks like this: information technologies and electronics, production technologies, new materials and chemical products, life systems technologies, transportation, fuels and energy, ecology and reasonable use of nature. The list brings together about 70 technologies. "Priority Areas of Fundamental Research" have been singled out. The minister noted that determining priorities was not the most difficult matter; it would be a lot harder to incorporate them into the organizational structure and system for distributing money already in place.

In B. Saltykov's opinion, completion of the draft of a law "On Science and State Scientific-Technical Policy" gives another reason to consider the year a success. "What happened to our bill, by that I mean its return to the Duma, in no way detracts from the significance of this document," noted the minister.

Among the most important programs that were carried out with participation of the ministry, Boris Georgyevich singled out two: the program of support of leading schools of science, and the program of development of telecommunications in science and education. "I do not believe that I need explain what being connected to the Internet means to Russian scientists sitting on an information-starved pike."

In 1995, science organizations were released from property taxation, and as a result were able to save about half a trillion rubles. There was an increase in the number of extrabudgetary funds supporting science. More money was allocated for science in outlying regions.

What remains to be done in 1996?

"Unfortunately, the top-priority task is still stabilization of financing," says B. Saltykov. "Moreover, work has to be continued on structural reorganization of the network of science institutions. The main idea of restructuring is to give scientists the opportunity of access to property that is already available in the area of science and engineering, with maximum benefit to science.

"We have not yet managed to concentrate resources on priority areas. It's just theory for the moment. And a lot remains to be done here.

"It is also very important to work out mechanisms of a specific system of reimbursable funding. This should give a push to innovative activity. Experience with the Fund for Aid to Development of Small Businesses in the field of science and engineering has shown that good results are possible there.

"Our international contacts were activated last year. Seven intergovernmental and nine interdepartmental agreements were signed. But with increasing activity in the international arena, the problem of protecting intellectual property has become more acute. We have been ordered by the president to prepare a list of normative acts that would prevent leakage of technologies.

"And finally, we recently received a resolution of the presidium of the government on downsizing MINNAUKA. We will be reorganizing in the near future."

Russian Scientists Protest Failure to Pay Wages

NEZAVISIMAYA *Moscow PUTSH in Russian 20-26 Feb 96, p 1*

[Article by Igor Germanov: "The Last Bell"]

[FBIS Translated Text] A scientist's pay today has become commensurate with the price of a ticket for Moscow's public transport. The worker in science can no longer go five or six times a week to his place of work, but rather is forced either to stay home or to earn his bread somewhere on the side.

Nevertheless, even even those who are unselfishly working in science may have this satisfaction taken away. At the start of 1996, the arrears of most academy-affiliated institutes for electric power and public services had reached an amount equal to two months of basic funding.

Over the past two months, the situation has become catastrophic. In December, state budgetary financing had dropped to zero, and in January it was cut to half as compared with 1995. Within two or three months, there will be nothing left to fund, reorganize or save — institutes may declare bankruptcy.

The cup of patience has overflowed, and scientists have decided to take decisive action. This time, in contrast to protests that have already been held, the initiative did not come "from above," from the trade union leaders and academy workers themselves. Groups have started to arise that are ready, according to Viktor Kalinushkin, chairman of the Coordination Committee of Science Collectives of the Russian Academy of Sciences, to go on a hunger strike and block busy thoroughfares.

Doing their best to make these actions civilized and organized, the workers' trade union and the Coordination Committee of Science Collectives of the Russian

Academy of Sciences have taken charge of the strike movement, and have set forth the following demands:

The RF government together with the nation's leading scientists shall work out and submit to the State Duma for legislative ratification prior to 1 May 1996 a specific program for extricating science from the crisis.

As an emergency measure, amendments shall be made to the 1996 state budget that provide for doubling of science funding. These amendments shall be ratified by legislative procedures prior to 1 April. The government shall be obligated to strict fulfillment of the 1996 budget, and back payment for 1995 to research teams before 25 February.

The first stage of the struggle to meet these demands has been marked by meetings and assemblies of the science community that have started throughout Russia. For example, one of the items of a resolution passed by an assembly held in the Great Hall of the St. Petersburg Science Center states: "To express loss of confidence in the President and the Government of the Russian Federation for failure to meet the laws on the federal budget for 1995-1996."

"But Moscow colleagues at their own meeting, where at least 5000 took part in assessment of the leadership of the trade union of workers of the Russian Academy of Sciences, showed more restraint. They appealed to the President, the Government, factions and deputies of the State Duma with a proposal that the official position toward the demands of scientists be stated before 1 March. In case of refusal of the state authorities to meet these demands, those attending the meeting deemed it necessary to call a general assembly of the Russian Academy of Sciences for a discussion with the government of what is to become of Russian science.

In addition, they plan to organize picketing of offices and organizations that ignore these demands, and even to start getting ready for a hunger strike.

There has also been an appeal to the Mayor, Government and Duma of Moscow with a request for consideration of preferential treatment in regard to payment for public services on the part of science institutions under federal jurisdiction.

The council of the trade union of the Russian Academy of Sciences together with other interested trade unions has been charged with holding talks with agencies of the executive and legislative authorities, and reporting to the science community with regard to results achieved. In case of necessity, a repeat meeting may be held in March of this year.

Russian Academicians Urge Caution Over Payments Crisis

SEGODNEVNIE *Moscow PUSH on Russian 20-26 Feb 96 p 1*

[Article by Igor Goryunov: "Don't Pour Salt on RAS"]

[FBIS Translated Text] As we know, before the end of the month the government is obligated, according to B. Yeltsin, to "complete liquidation" of the debt to fundamental science. It is fundamental research that is meant, and not science in general. According to an article in "SCIENCE," the total sum of government debts is edging up toward one and a half trillion rubles. In the given case, a mere 480 billion has been allocated, of which the Russian Academy of Sciences will get 266. There is a payment of 181.3 billion due the central institutions of the RAS, which would enable scientists to be paid the salary they did not receive in December and January.

As usual, there won't be enough money for anything else. However, "shaking out" even these undecided billions had to go "through Chernomyrdin." The results of serious talks of RAS President Yu. Osipov with the Prime Minister and the government's subsequent numerous pronouncements of love for fundamental science allow us to hope that the 266 billion will actually be paid, and scientists will not be left entirely without means of subsistence.

At the same time, in the opinion of RAS Vice President A. Gorchar, which he expressed at the last meeting of the presidium, the steps that the government is taking to come to terms primarily with the Russian Academy of Sciences, merit approval. The RAS leadership really does esteem them highly. On the other hand, the academy trade unions, to judge from everything, do not. The contemplated addresses of the science community were delivered anyway, despite the latest orders for funding.

Given today's state of affairs, these addresses, in the opinion of some RAS leaders, are inappropriate. "The way things are, when there's no money, it's bad, and when there is money, that's bad, too. Now the situation has become more complicated to some extent" in the way that Academician A. Gorchar sums it up, meaning the unswerving resolutions of trade unions to carry out their planned action. In these addresses one can, of course, blame the government for procrastination and other sins. But the main thing is "not to overdo it" at the time when it is academy problems that the government is trying with gritting teeth to solve.

Since the money has been given, the content of meetings is taking on a more general nature. But "non-remedicine"